U.S. Department of Agriculture
Grain Inspection, Packers and Stockyards
Administration
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CHAPTER 2

MOISTURE METER CALIBRATION

2.1 GENERAL REQUIREMENTS

GIPSA is responsible for developing, implementing, and maintaining calibrations used with the official meter. ISE periodically verifies the accuracy of moisture meter calibrations used in the official system. The calibrations for the major grains inspected under the United States Grain Standards Act and the major classes of rough rice are checked annually. All other calibrations are checked on a nine-year cycle.

2.2 SCHEDULE

a. The commodities requiring annual calibration review are:

(1) Barley (Two- and Six-rowed)
(2) Corn
(3) Oats
(4) Rough Rice (Long Grain and Medium Grain)
(5) Sorghum
(6) Soybeans
(7) Sunflower Seed (Oil Type)
(8) Durum Wheat
(9) Hard Red Spring Wheat
(10) Hard White Wheat
(11) Soft White Wheat
(12) Hard Red Winter Wheat
(13) Soft Red Winter Wheat

b. The commodities requiring nine-year cyclical review are:

(1) Cycle years 1-3. Black beans, Great Northern beans, Pea (Navy) beans, Pinto beans, canola, flaxseed, rapeseed, Brewers Milled rice, Long Grain Brown rice, Long Grain Brown rice (Parboiled), Long Grain Milled rice, Long Grain Milled rice (Parboiled), Medium Grain Brown rice, Medium Grain Milled rice, and rye.

(2) Cycle years 4-6. Black Eye beans, Dark Red Kidney beans, Light Red Kidney beans, Small Red beans, Lentils, Smooth Dry peas, Split peas, Wrinkled Dry peas, Brewers Milled rice (Parboiled), Medium Grain Milled rice (Parboiled), Second Head Milled rice (Long/Medium Grain), Short Grain Rough rice, safflower seed, and sunflower seed (Confectionery).

(3) Cycle years 7-9. Cranberry beans, Garbanzo beans, Baby Lima beans, Large Lima beans, Pink beans, Small White beans, Yelloweye beans, Austrian Winter peas, Brown mustard seed, Oriental mustard seed, Yellow mustard seed, Medium Grain Milled rice (Coated), Screenings Milled rice, Short Grain Brown rice, Short Grain Milled rice, Short Grain Second Head Milled rice, Second Head Milled rice (Parboiled), and triticale.

c. The order of testing other commodities will be determined based on economic importance, market interest, sample availability, and program resources.

2.3 EQUIPMENT REQUIREMENTS

a. The DICKEY-john Grain Analysis Computer GAC 2100 is the designated official moisture meter for work within the official system. Due to the amount of work involved in deriving official GAC 2100 calibrations for all grains, a transition period is required. For any given grain, the Motomco Model 919 will continue to be used until the official GAC 2100 calibration is implemented for that grain.

b. All moisture meters, test weight apparatuses, and balances shall be approved, maintained, used, and tested in accordance with this handbook, the Grain Inspection Handbook, and the Equipment Handbook.

c. GIPSA Headquarters shall maintain four Standard meters, three of which are kept in service as working Standard units. The remaining meter is a back-up unit, ready to be placed into service if one of the three Standard meters fails. All Headquarters Standard units must pass an initial test and, subsequently, the regularly scheduled maintenance tests. Procedures for these tests are outlined in Chapter 3.

2.4 ANNUAL CALIBRATION STUDY

a. Sample Collection Notice. Sample collection assignments are communicated to GIPSA field offices in the spring of each year through a sample collection notice. TSD will submit the notice for the new crop year by April 15.

(1) The notice states which calibrations are being evaluated, the offices responsible for submitting samples, the numbers and types of samples needed, and moisture range for each commodity under study. The number of samples requested from each office is based on production within the geographical area of responsibility.

(2) The moisture ranges and total numbers of samples requested for calibration review are given in Table 2.1.

b. Sample Collection Procedures. The purpose of the sample collection effort is to obtain representative samples from the entire nation. It is understood that all requested moisture levels may not be available in all areas every year. Since a wide moisture range is important to the study, field offices should make all reasonable efforts to provide the requested samples. Submitted samples should be natural; that is, the moisture should not be adjusted by adding water or drying in the laboratory. Samples should weigh at least 1,200 grams; however, when only underweight samples are available, they may be used in the study. More specific instructions will be given in each current year's annual notice.

c. Sample Handling. Upon receipt of a sample, TSD assigns an identification number and records the date received, source, grain type, moisture, and other pertinent information in the sample log. The integrity of the sample bag is checked and the sample is rebagged if needed. Polyethylene bags (six mil thickness) are used. Bags are heat sealed. Samples are stored at 35-45 EF unless tested within 24 hours of receipt.

d. Sample Testing.

(1) Samples are scheduled for testing in order of decreasing moisture content. Prior to testing, samples are removed from cold storage and equilibrated overnight to room temperature. (Samples over 18 percent moisture are equilibrated to room temperature on the day of testing.)

(2) Samples with objectionable amounts of foreign material are hand-sieved before testing. The condition of the sample (odor, appearance, damage, remaining foreign material, etc.) is recorded on a data sheet. TSD mixes the sample, determines the test weight, and records the result.

(3) The sample is then divided into representative portions slightly in excess of the amounts needed for meter plus air oven analysis. An initial air oven portion is withdrawn and sealed in an airtight container.

(4) TSD tests each sample on the official meter model at room temperature according to instructions in Book II, Chapter 1 of the Grain Inspection Handbook. A minimum of two measurements on each of two meters is collected; however, this number may be increased to accommodate special projects.

(5) In addition to the official model, other NTEP-certified models may be included in the annual moisture calibration study under the NTEP Program.

(6) Precautions are taken to control the effects of moisture loss during testing.

(a) Samples are kept sealed in moisture-proof containers except during actual meter testing. Air oven portions are withdrawn before and after meter testing and sealed in moisture-tight containers.

(b) Air oven moistures are determined on each portion, and the results are averaged.

(c) The total number of drops done on any meter portion is limited to twelve (except on a very few small samples which cannot be subdivided). When collecting data on multiple meter models (for instance, the NTEP certified models), data for the official model are collected midway.

(d) When testing samples above 18 percent moisture, half of the samples are randomly selected and tested in reverse order to prevent biasing the results of any model due to moisture loss. Special projects are supported by additional air oven testing.

(7) Air oven portions are tested by the USDA air oven method for grain moisture determination. Duplicate analyses are run on both the initial and final portions (a total of four analyses per sample).

(8) TSD reviews the data and investigates questionable results and instrument bias trends. When all tests for a particular commodity are completed, TSD submits the data for statistical processing.

2.5 REPORTS

a. Statistical Output. A separate statistical report is generated for each commodity studied. Each report contains multi-year reviews (at least 3 years of data), including:

(1) Plots of meter bias vs. air oven moisture;

(2) Charts showing meter bias by 2 percent moisture intervals; and

(3) Data summary tables listing numbers of samples, instrument bias values, standard deviations of the bias values, 95 percent confidence intervals, tolerance violations (if applicable), and instrument repeatability.

b. Moisture Reports. TSD prepares separate moisture reports for the official model on each calibration evaluated. Each report will be issued not later than 45 days prior to the normal start of harvest in the principal area(s) of production. The reports will include:

(1) A table listing the sources of samples and the number received from each location;

(2) A table reporting multi-year summary statistics;

(3) A multi-year review of meter bias versus air oven moisture and of yearly average and multi-year average bias patterns; and

(4) A summary of calibration accuracy, significant tolerance violations, and recommendations regarding the calibration.

2.6 CRITERIA FOR CHANGES

Moisture calibrations for the official model are evaluated for possible correction under the following rules:

a. General Rule. A calibration should be revised if the three- or five-year data reviews show that any 2 percent moisture interval has an average bias that exceeds (at a confidence level of 95 percent) ±0.30 percent moisture. (The bias tolerance is ±0.50 percent moisture for corn above 15 percent moisture, sorghum above 21 percent moisture, and sunflower seed above 14.75 percent moisture.)

b. Rule for sustained biases not corrected by the General Rule. A calibration is considered for bias correction when all of the following conditions are met:

(1) The three-year average calibration bias (the three-year average bias over the entire range) exceeds 0.15 percent moisture,

(2) The most recent three-year average calibration bias exceeds twice the standard deviation of past three-year average calibration biases.

c. Special Circumstances. Unusual situations (such as abnormal crop years) that justify exceptions to the above rules are treated on a case-by-case basis.

2.7 SAMPLE LIST

Table 2.1, Moisture Ranges and Numbers of Samples Requested.

Commodity	Assigned Moisture Range (%)	No. Samples Requested
Barley	8 to 20	60
Corn	8 to 30	260
Flaxseed	5 to 15	40
Oats	8 to 20	80
Rye	8 to 20	60
Sorghum	8 to 25	60
Soybeans	8 to 20	210
Sunflower Seed	5 to 25	130
Wheat - Durum	7 to 20	70
- Hard Red Spring	7 to 20	70
- Hard White	7 to 20	60
- Soft White	8 to 20	60
- Hard Red Winter	8 to 20	70
- Soft Red Winter	7 to 20	60
Edible Beans	8 to 20	40 (per kind)
Lentils	7 to 20	50
Peas - Wrinkled Dry	7 to 20	50
- All Other Kinds	8 to 20	50 (per kind)
Canola and Rapeseed	4 to 15	50
Rough Rice	7 to 25	80 (per class)
Processed Rice (not parboiled)	10 to 16	60 (per class)
Processed Rice (parboiled)	10 to 20	60 (per class)
Safflower Seed	3 to 15	50